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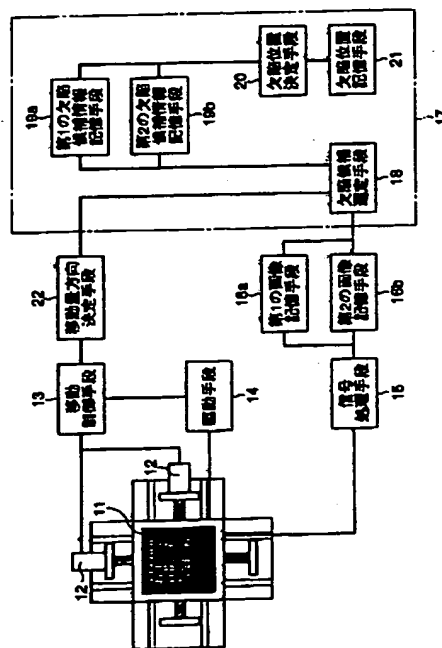
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(54)【発明の名称】 欠陥画素検出装置、欠陥画素検出方法、撮像装置、撮像方法および記憶媒体

(57)【要約】

【課題】 均一な光量の照明を使用することなく欠陥画素を検出できるようにする。

【解決手段】 複数の画素を有する固体撮像素子１１を所定方向に所定量だけ移動させる移動手段１３と、前記固体撮像素子１１の撮像動作を制御して画像情報を生成させる撮像制御手段１４と、前記固体撮像素子１１から出力される画像情報をもとにして前記固体撮像素子の欠陥位置を検出する欠陥位置検出手段２０とを設け、欠陥画素検出装置の構成を簡素化するとともに、正確な欠陥画素検出を行うことができるようにする。



【特許請求の範囲】

【請求項1】 複数の画素を有する固体撮像素子の欠陥画素を検出する欠陥画素検出装置であって、前記固体撮像素子を所定方向に所定量だけ移動させる移動手段と、

前記固体撮像素子の撮像動作を制御して画像情報を生成させる撮像制御手段と、

前記固体撮像素子から出力される画像情報をもとにして、前記固体撮像素子の欠陥位置を検出する欠陥位置検出手段とを有することを特徴とする欠陥画素検出装置。

【請求項2】 複数の画素を有する固体撮像素子の欠陥画素を検出する欠陥画素検出装置であって、前記固体撮像素子を所定方向に所定量だけ移動させる移動手段と、

前記移動手段によって移動される固体撮像素子の撮像動作を制御して複数の画像情報を生成させる撮像制御手段と、

前記固体撮像素子が出力する複数の画像情報を処理する信号処理手段と、

前記信号処理手段から出力される画像情報を記憶する画像情報記憶手段と、

前記画像情報記憶手段から読み出された複数の画像情報をもとに前記固体撮像素子の欠陥位置を検出する欠陥位置検出手段とを有することを特徴とする欠陥画素検出装置。

【請求項3】 前記欠陥位置検出手段は、前記画像情報記憶手段に記憶された画像情報をもとに、前記固体撮像素子の欠陥候補を選定する欠陥候補選定手段と、

前記欠陥候補選定手段が選定した欠陥候補情報を記憶する欠陥候補情報記憶手段と、

前記欠陥候補情報記憶手段の欠陥候補情報をもとに、前記固体撮像素子の欠陥位置を決定する欠陥位置決定手段と、

前記欠陥位置決定手段が決定した前記固体撮像素子の欠陥位置を記憶する欠陥位置記憶手段とを有することを特徴とする請求項2に記載の欠陥画素検出装置。

【請求項4】 前記欠陥候補選定手段が選定した欠陥候補情報をもとに前記移動手段の移動方向および移動量を決定する移動量方向決定手段を有することを特徴とする請求項3に記載の欠陥画素検出装置。

【請求項5】 複数の画素を有する固体撮像素子と、前記固体撮像素子を所定方向に所定量だけ移動させる移動手段と、

前記移動手段によって移動させられる固体撮像素子の撮像動作を制御して画像情報を生成させる撮像制御手段と、

前記移動手段により前記固体撮像素子を移動させながら取り込んだ複数の画像情報をもとにして前記固体撮像素子の欠陥位置を検出して欠陥位置情報を出力する欠陥位

置検出手段と、

前記欠陥位置検出手段から出力される欠陥位置情報をもとに、前記固体撮像素子により生成された画像情報に基づいて欠陥画素を補正する欠陥画素補正手段とを有することを特徴とする撮像装置。

【請求項6】 複数の画素を有する固体撮像素子と、前記固体撮像素子を所定方向に所定量だけ移動させる移動手段と、

前記移動手段によって移動される固体撮像素子の撮像動作を制御して複数の画像情報を生成させる撮像制御手段と、前記固体撮像素子が出力する画像情報を処理する信号処理手段と、

前記信号処理手段が出力した画像情報を記憶する画像情報記憶手段と、

前記移動手段により前記固体撮像素子を移動させながら取り込んだ複数の画像情報をもとに前記固体撮像素子の欠陥位置を検出する欠陥位置検出手段と、

前記欠陥位置検出手段から出力される欠陥位置情報をもとに、前記固体撮像素子により生成された画像情報に基づいて欠陥画素を補正する欠陥画素補正手段とを有することを特徴とする撮像装置。

【請求項7】 前記欠陥位置検出手段は、前記画像情報記憶手段に記憶された画像情報をもとに、前記固体撮像素子の欠陥候補を選定する欠陥候補選定手段と、

前記欠陥候補選定手段が選定した欠陥候補情報を記憶する欠陥候補情報記憶手段と、

前記欠陥候補情報記憶手段の欠陥候補情報をもとに、前記固体撮像素子の欠陥位置を決定する欠陥位置決定手段と、

前記欠陥位置決定手段が決定した前記固体撮像素子の欠陥位置を記憶する欠陥位置記憶手段とを有することを特徴とする請求項6に記載の撮像装置。

【請求項8】 前記欠陥候補選定手段が選定した欠陥候補情報をもとに前記移動手段の移動方向および移動量を決定する移動量方向決定手段を有することを特徴とする請求項7に記載の撮像装置。

【請求項9】 複数の画素を有する固体撮像素子を用いる欠陥画素検出方法であって、

前記固体撮像素子を所定方向に所定量だけ移動させる移動処理と、

前記移動処理によって移動される固体撮像素子の撮像動作を制御して複数の画像情報を生成させる撮像制御処理と、

前記撮像制御処理により生成した複数の画像情報をもとにして前記固体撮像素子の欠陥位置を検出する欠陥位置検出処理とを行うことを特徴とする欠陥画素検出方法。

【請求項10】 複数の画素を有する固体撮像素子を用いる欠陥画素検出方法であって、

前記固体撮像素子を所定方向に所定量だけ移動させる移

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動処理と、
前記固体撮像素子の撮像動作を制御する撮像処理と、
前記固体撮像素子が出力する画像情報を処理する信号処理と、
前記信号処理された画像情報を記憶する画像情報記憶処理と、
前記移動処理により前記固体撮像素子を移動させながら、取り込んだ複数の画像情報をもとに前記固体撮像素子の欠陥位置を検出する欠陥位置検出処理とを行うことを特徴とする欠陥画素検出方法。

【請求項11】 前記欠陥位置検出処理は、
前記画像情報記憶処理の画像情報をもとに、前記固体撮像素子の欠陥候補を選定する欠陥候補選定処理と、
前記欠陥候補選定処理が選定した欠陥候補情報を記憶する欠陥候補情報記憶処理と、
前記欠陥候補情報記憶処理の欠陥候補情報をもとに、前記固体撮像素子の欠陥位置を決定する欠陥位置決定処理と、
前記欠陥位置決定処理が決定した前記固体撮像素子の欠陥位置を記憶する欠陥位置記憶処理とを行うことを特徴とする請求項10に記載の欠陥画素検出方法。

【請求項12】 前記欠陥候補選定処理が選定した欠陥候補情報をもとに前記移動処理の移動方向および移動量を決定する移動量方向決定処理を有することを特徴とする請求項11に記載の欠陥画素検出方法。

【請求項13】 複数の画素を有する固体撮像素子を所定方向に所定量だけ移動させる移動処理と、
前記移動処理によって移動させられる固体撮像素子の撮像動作を制御して画像情報を生成させる撮像制御処理と、

前記移動処理により前記固体撮像素子を移動させながら取り込んだ複数の画像情報をもとにして前記固体撮像素子の欠陥位置を検出して欠陥位置情報を出力する欠陥位置検出処理と、
前記欠陥位置検出処理から出力される欠陥位置情報をもとに、前記固体撮像素子により生成された画像情報に基づいて欠陥画素を補正する欠陥画素補正処理とを行うことを特徴とする撮像方法。

【請求項14】 複数の画素を有する固体撮像素子と、
前記固体撮像素子を所定方向に所定量だけ移動させる移動処理と、
前記移動処理によって移動される固体撮像素子の撮像動作を制御して複数の画像情報を生成させる撮像制御処理と、前記固体撮像素子が出力する画像情報を処理する信号処理と、
前記信号処理が出力した画像情報を記憶する画像情報記憶処理と、
前記移動処理により前記固体撮像素子を移動させながら取り込んだ複数の画像情報をもとに前記固体撮像素子の欠陥位置を検出する欠陥位置検出処理と、

前記欠陥位置検出処理から出力される欠陥位置情報をもとに、前記固体撮像素子により生成された画像情報に基づいて欠陥画素を補正する欠陥画素補正処理とを行うことを特徴とする撮像方法。

【請求項15】 前記欠陥位置検出処理は、
前記画像情報記憶処理に記憶された画像情報をもとに、前記固体撮像素子の欠陥候補を選定する欠陥候補選定処理と、
前記欠陥候補選定処理が選定した欠陥候補情報を記憶する欠陥候補情報記憶処理と、
前記欠陥候補情報記憶処理の欠陥候補情報をもとに、前記固体撮像素子の欠陥位置を決定する欠陥位置決定処理と、
前記欠陥位置決定処理が決定した前記固体撮像素子の欠陥位置を記憶する欠陥位置記憶処理とを行うことを特徴とする請求項14に記載の撮像方法。

【請求項16】 前記欠陥候補選定処理が選定した欠陥候補情報をもとに前記移動処理の移動方向および移動量を決定する移動量方向決定処理を行うことを特徴とする請求項15に記載の撮像方法。

【請求項17】 請求項1～8の何れか1項に記載の各手段としてコンピュータに機能させるためのプログラムを格納したことを特徴とする記憶媒体。

【請求項18】 請求項9～16の何れか1項に記載の各処理の手順をコンピュータに実行させるためのプログラムを格納したことを特徴とする記憶媒体。

【発明の詳細な説明】

【0001】

【発明の属する技術分野】本発明は、欠陥画素検出装置、欠陥画素検出方法、撮像方法、撮像装置および記憶媒体に関し、特に、欠陥画素を有する固体撮像素子の欠陥画素の位置を検出する装置、光応答の特異な欠陥画素の位置を検出する装置に関するものである。

【0002】

【従来の技術】ビデオカメラや電子スチルカメラなどに用いられるCCD等の固体撮像素子は、その製造過程において複数の欠陥画素を生じる。そのため、欠陥画素の出力を前置画素と置換したり、または欠陥画素が接する周囲画素の平均値で置換して欠陥の無い画像を出力するようにしていた。

【0003】これらの欠陥には、おもに暗電流の応答がその周囲の画素より高いために白点を生じる白欠陥や、画素の光応答がその周囲の画素より低いために黒点を生じる黒欠陥等がある。

【0004】従来より、これら欠陥画素の検出には、固体撮像素子内や周辺画素の平均値に一定の幅をもたせた閾値と比較して、その値に対して特異なレベルを出力する画素を欠陥画素として検出していた。

【0005】

【発明が解決しようとする課題】前記のような欠陥画素

の検出方法では、光応答が特異な欠陥を検出するために均一な光量の照明を必要とし、その照明に斑等の異常が生じた場合には、正常な画素であるにもかかわらず、欠陥と判定されてしまうことがあった。

【0006】本発明は前述の問題点にかんがみ、均一な光量の照明を使用することなく欠陥画素を高精度に検出できるようにすることを目的とする。

【0007】

【課題を解決するための手段】前記目的を達成するために、本発明に関わる欠陥画素検出装置は、複数の画素を有する固体撮像素子の欠陥画素を検出する欠陥画素検出装置であって、前記固体撮像素子を所定方向に所定量だけ移動させる移動手段と、前記固体撮像素子の撮像動作を制御して画像情報を生成させる撮像制御手段と、前記固体撮像素子から出力される画像情報をもとにして前記固体撮像素子の欠陥位置を検出する欠陥位置検出手段とを有することを特徴としている。

【0008】また、本発明の欠陥画素検出装置の他の特徴とするところは、複数の画素を有する固体撮像素子の欠陥画素を検出する欠陥画素検出装置であって、前記固体撮像素子を所定方向に所定量だけ移動させる移動手段と、前記移動手段によって移動される固体撮像素子の撮像動作を制御して複数の画像情報を生成させる撮像制御手段と、前記固体撮像素子が出力する複数の画像情報を処理する信号処理手段と、前記信号処理手段から出力される画像情報を記憶する画像情報記憶手段と、前記画像情報記憶手段から読み出された複数の画像情報をもとに前記固体撮像素子の欠陥位置を検出する欠陥位置検出手段とを有することを特徴としている。

【0009】また、本発明の欠陥画素検出装置の他の特徴とするところは、前記欠陥位置検出手段は、前記画像情報記憶手段に記憶された画像情報をもとに、前記固体撮像素子の欠陥候補を選定する欠陥候補選定手段と、前記欠陥候補選定手段が選定した欠陥候補情報を記憶する欠陥候補情報記憶手段と、前記欠陥候補情報記憶手段の欠陥候補情報をもとに、前記固体撮像素子の欠陥位置を決定する欠陥位置決定手段と、前記欠陥位置決定手段が決定した前記固体撮像素子の欠陥位置を記憶する欠陥位置記憶手段とを有することを特徴としている。

【0010】また、本発明の欠陥画素検出装置の他の特徴とするところは、前記欠陥候補選定手段が選定した欠陥候補情報をもとに前記移動手段の移動方向および移動量を決定する移動量方向決定手段を有することを特徴としている。

【0011】また、本発明の撮像装置は、複数の画素を有する固体撮像素子と、前記固体撮像素子を所定方向に所定量だけ移動させる移動手段と、前記移動手段によって移動させられる固体撮像素子の撮像動作を制御して画像情報を生成させる撮像制御手段と、前記移動手段により前記固体撮像素子を移動させながら取り込んだ複数の

画像情報をもとにして前記固体撮像素子の欠陥位置を検出して欠陥位置情報を出力する欠陥位置検出手段と、前記欠陥位置検出手段から出力される欠陥位置情報をもとに、前記固体撮像素子により生成された画像情報に基づいて欠陥画素を補正する欠陥画素補正手段とを有することを特徴としている。

【0012】また、本発明の撮像装置の他の特徴とするところは、複数の画素を有する固体撮像素子と、前記固体撮像素子を所定方向に所定量だけ移動させる移動手段と、前記移動手段によって移動される固体撮像素子の撮像動作を制御して複数の画像情報を生成させる撮像制御手段と、前記固体撮像素子が出力する画像情報を処理する信号処理手段と、前記信号処理手段が出力した画像情報を記憶する画像情報記憶手段と、前記移動手段により前記固体撮像素子を移動させながら取り込んだ複数の画像情報をもとに前記固体撮像素子の欠陥位置を検出する欠陥位置検出手段と、前記欠陥位置検出手段から出力される欠陥位置情報をもとに、前記固体撮像素子により生成された画像情報に基づいて欠陥画素を補正する欠陥画素補正手段とを有することを特徴としている。

【0013】また、本発明の撮像装置のその他の特徴とするところは、前記欠陥位置検出手段は、前記画像情報記憶手段に記憶された画像情報をもとに、前記固体撮像素子の欠陥候補を選定する欠陥候補選定手段と、前記欠陥候補選定手段が選定した欠陥候補情報を記憶する欠陥候補情報記憶手段と、前記欠陥候補情報記憶手段の欠陥候補情報をもとに、前記固体撮像素子の欠陥位置を決定する欠陥位置決定手段と、前記欠陥位置決定手段が決定した前記固体撮像素子の欠陥位置を記憶する欠陥位置記憶手段とを有することを特徴としている。

【0014】また、本発明の撮像装置のその他の特徴とするところは、前記欠陥候補選定手段が選定した欠陥候補情報をもとに前記移動手段の移動方向および移動量を決定する移動量方向決定手段を有することを特徴としている。

【0015】また、本発明の欠陥画素検出方法の特徴とするところは、複数の画素を有する固体撮像素子を用いる欠陥画素検出方法であって、前記固体撮像素子を所定方向に所定量だけ移動させる移動処理と、前記移動処理によって移動される固体撮像素子の撮像動作を制御して複数の画像情報を生成させる撮像制御処理と、前記撮像制御処理により生成した複数の画像情報をもとにして前記固体撮像素子の欠陥位置を検出する欠陥位置検出処理とを行うことを特徴としている。

【0016】また、本発明の欠陥画素検出方法の他の特徴とするところは、複数の画素を有する固体撮像素子を用いる欠陥画素検出方法であって、前記固体撮像素子を所定方向に所定量だけ移動させる移動処理と、前記固体撮像素子の撮像動作を制御する撮像処理と、前記固体撮像素子が出力する画像情報を処理する信号処理と、前記

信号処理された画像情報を記憶する画像情報記憶処理と、前記移動処理により前記固体撮像素子を移動させながら、取り込んだ複数の画像情報をもとに前記固体撮像素子の欠陥位置を検出する欠陥位置検出処理とを行うことを特徴としている。

【0017】また、本発明の欠陥画素検出方法のその他の特徴とするところは、前記欠陥位置検出処理は、前記画像情報記憶処理の画像情報をもとに、前記固体撮像素子の欠陥候補を選定する欠陥候補選定処理と、前記欠陥候補選定処理が選定した欠陥候補情報を記憶する欠陥候補情報記憶処理と、前記欠陥候補情報記憶処理の欠陥候補情報をもとに、前記固体撮像素子の欠陥位置を決定する欠陥位置決定処理と、前記欠陥位置決定処理が決定した前記固体撮像素子の欠陥位置を記憶する欠陥位置記憶処理とを行うことを特徴としている。

【0018】また、本発明の欠陥画素検出方法のその他の特徴とするところは、前記欠陥候補選定処理が選定した欠陥候補情報をもとに前記移動処理の移動方向および移動量を決定する移動量方向決定処理を有することを特徴としている。

【0019】また、本発明の撮像方法の特徴とするところは、複数の画素を有する固体撮像素子を所定方向に所定量だけ移動させる移動処理と、前記移動処理によって移動させられる固体撮像素子の撮像動作を制御して画像情報を生成させる撮像制御処理と、前記移動処理により前記固体撮像素子を移動させながら取り込んだ複数の画像情報をもとにして前記固体撮像素子の欠陥位置を検出して欠陥位置情報を出力する欠陥位置検出処理と、前記欠陥位置検出処理から出力される欠陥位置情報をもとに、前記固体撮像素子により生成された画像情報に基づいて欠陥画素を補正する欠陥画素補正処理とを行うことを特徴としている。

【0020】また、本発明の撮像方法の他の特徴とするところは、複数の画素を有する固体撮像素子と、前記固体撮像素子を所定方向に所定量だけ移動させる移動処理と、前記移動処理によって移動される固体撮像素子の撮像動作を制御して複数の画像情報を生成させる撮像制御処理と、前記固体撮像素子が出力する画像情報を処理する信号処理と、前記信号処理が出力した画像情報を記憶する画像情報記憶処理と、前記移動処理により前記固体撮像素子を移動させながら取り込んだ複数の画像情報をもとに前記固体撮像素子の欠陥位置を検出する欠陥位置検出処理と、前記欠陥位置検出処理から出力される欠陥位置情報をもとに、前記固体撮像素子により生成された画像情報に基づいて欠陥画素を補正する欠陥画素補正処理とを行うことを特徴としている。

【0021】また、本発明の撮像方法の他の特徴とするところは、前記欠陥位置検出処理は、前記画像情報記憶処理に記憶された画像情報をもとに、前記固体撮像素子の欠陥候補を選定する欠陥候補選定処理と、前記欠陥候

補選定処理が選定した欠陥候補情報を記憶する欠陥候補情報記憶処理と、前記欠陥候補情報記憶処理の欠陥候補情報をもとに、前記固体撮像素子の欠陥位置を決定する欠陥位置決定処理と、前記欠陥位置決定処理が決定した前記固体撮像素子の欠陥位置を記憶する欠陥位置記憶処理とを行うことを特徴としている。

【0022】また、本発明の撮像方法の他の特徴とするところは、前記欠陥候補選定処理が選定した欠陥候補情報をもとに前記移動処理の移動方向および移動量を決定する移動量方向決定処理を行うことを特徴としている。

【0023】また、本発明の記憶媒体の特徴とするところは、前記各手段としてコンピュータに機能させるためのプログラムを格納したことを特徴としている。

【0024】また、本発明の記憶媒体の他の特徴とするところは、前記各処理の手順をコンピュータに実行させるためのプログラムを格納したことを特徴としている。

【0025】

【発明の実施の形態】以下に、添付図面を参照しながら本発明の実施の形態を詳細に説明する。図1は、本発明の欠陥画素検出装置の構成図である。図1に示すように、検査対象の固体撮像素子11は複数のマトリクス状に配列した受光素子からなり、移動手段12上に配置されている。

【0026】移動手段12は、移動制御手段13によりその動作が制御され、固体撮像素子11は駆動手段14によって駆動制御される。

【0027】駆動手段14は、移動制御手段13とも結合させており、駆動と移動のタイミングを図っている。前記移動手段12は、例えばボールネジをスッテッピングモータ、またはサーボモータで駆動させて固体撮像素子11を固定したテーブルを移動させる構造になっている。

【0028】そして、固体撮像素子11から出力される信号は、信号処理手段15によってアナログ・デジタル(A/D)変換され、撮影毎に第1の画像記憶手段16a、第2の画像記憶手段16bにそれぞれ記憶される。なお、本実施の形態では、2個の画像記憶手段を図示しているが、もちろんこの数に限定することではなく、複数の画像を記憶できる所定の容量があればよい。この第1および第2の画像記憶手段16a、16bは具体的にはRAMやHDのような読書き可能な記憶媒体である。

【0029】固体撮像素子11の欠陥画素を検出する欠陥画素検出手段17は、例えば、欠陥候補選定手段18と第1の欠陥候補情報記憶手段19a、第2の欠陥候補情報記憶手段19bと、欠陥位置決定手段20、および欠陥位置記憶手段21からなる。ここでは、これらで構成される欠陥画素検出手段17について説明する。

【0030】欠陥候補選定手段18は、前述の第1の画像記憶手段16a、第2の画像記憶手段16bに記憶された画像をそれぞれ対応する画素毎に比較して、固体撮

像素子11の欠陥画素候補を選定する。

【0031】この選定過程で出力される演算出力は、第1の欠陥候補情報記憶手段19a、第2の欠陥候補情報記憶手段19bに記憶される。欠陥位置決定手段20は、第1の欠陥候補情報記憶手段19a、第2の欠陥候補情報記憶手段19bにそれぞれ記憶された欠陥候補情報をもとに、対応した画素毎をそれぞれ比較することによって、欠陥画素の位置を決定する。

【0032】ここで決定された欠陥画素の位置は、欠陥位置記憶手段21に記憶される。この欠陥位置記憶手段21に記憶された欠陥位置情報は、例えばROM焼き付け装置等の出力装置に出力することも可能である。

【0033】ここで、欠陥画素の検出方法を図2を用いて詳しく説明する。図2(A)は、5×5の受光像素子マトリクス状に配置した固体撮像素子11の出力を図示したもので、図中の網点部は固体撮像素子11の欠陥画素の出力を示している。

【0034】ここでは、説明を容易にするために欠陥画素を網点で示しているが、実際には欠陥画素の位置はこの時点ではわかっていない。この出力画像を、例えば第1の画像記憶手段16aに保存する。ちなみに、左上の黒点は画像の原点を理解しやすくするために記したものである。

【0035】次に、図2(B)に示すように、例えば1画素分、固体撮像素子11を右に移動させて画像を取得すると、図2(A)の座標より右に1画素分ずれた画像となる。同様にこの画像を、例えば第2の画像記憶手段16bに保存する。これら2つの画像を対応する画素毎に差分を取ると、図2(C)に示すように、欠陥画素に対応した画素の位置に特異な値を示す画像が得られる。この画像を、例えば第1の欠陥候補情報記憶手段19aに保存する。

【0036】今度は、図2(D)に示すように、例えば1画素分だけ固体撮像素子11を左に移動させて画像を取得すると、図2(A)の座標より左に1画素分ずれた画像となる。この画像を、例えば第2の画像記憶手段16bに上書き保存する。

【0037】この画像と、既に取得している図2(A)の画像とを対応する画素毎に差分を取ると、図2(E)に示すように、欠陥画素に対応した画素の位置に特異な値を示す画像が得られる。この画像を、例えば第2の欠陥候補情報記憶手段19bに保存する。

【0038】第1の欠陥候補情報記憶手段19aと第2の欠陥候補情報記憶手段19bに保存された画像、ここでは図2(C)と(E)とを対応する画素毎に論理積をとると、図2(F)に示すように、欠陥画素を検出することができる。検出された欠陥の位置は、欠陥位置記憶手段21に記憶される。

【0039】また、例えば、図3(A)に示すように、連続して欠陥画素が存在する場合は、図3(B)に示す

ように欠陥画素が連続する方向に固体撮像素子11を移動させた場合は、図3(C)に示すように、網点部は特異な値を示すが、その間の画素は欠陥画素値同士の差分を取ったために特異な値を示さないことがある。

【0040】また、図3(D)に示すように、逆方向に移動させたときも図3(E)に示すように、欠陥画素値同士の差分を取ったために同様に特異な値を示さない場合がある。図3(C)と図3(E)との論理積をとっても欠陥画素の位置を特定することはできない。

【0041】そこで、論理和をとって、図3(F)に示すような欠陥画素候補画像として、例えば第1の欠陥候補情報記憶手段19aに保存しておく。

【0042】次に、図3(G)に示すように、図3(B)と図3(D)とは異なる方向に移動させて、この画像と既に取得している図2(A)の画像とを対応する画素毎に差分を取ると、図2(H)に示すように、欠陥画素に対応した画素の位置に特異な値を示す画像が得られる。

【0043】この画像と先ほど保存した図3(F)との論理積をとると、図3(I)に示すように欠陥画素を決定することができる。このように移動量方向決定手段22は、それぞれの処理で検出される欠陥候補情報をもとに検出残しがないように移動方向や移動量を決定する手段である。移動量方向決定手段22は、欠陥候補選定手段18と結合しているとともに、移動制御手段13とも結合して移動量と方向を指定する。

【0044】以上の説明では、各画像を取得する回数は特に記述しなかったが、もちろん各画像とも複数回取得して、平均化した画像を用いて処理することで、ランダムノイズの影響を低減することができる。

【0045】また、本装置をビデオカメラ等の撮影装置に組み込んで、工場検査時には欠陥画素ではなかったが、その後生じた欠陥画素を検出する装置として用いることも可能である。

【0046】図4は、前述した欠陥画素検出方法の手順を示すフローチャートである。図4に示したように、本実施の形態の欠陥画素検出方法は、ステップS41で移動処理を行い、ステップS42で撮像処理を行い、ステップS43で信号処理を行い、ステップS44で画像情報記憶処理を行い、ステップS45で欠陥位置検出処理を行う。

【0047】前記移動処理は、前記固体撮像素子11を所定方向に所定量だけ移動させる処理である。また、前記撮像処理は、前記固体撮像素子11の撮像動作を制御して画像情報を取得する処理である。

【0048】前記信号処理は、前記固体撮像素子11が出力する画像情報に所定の信号処理を施す処理である。前記画像情報記憶処理は、前記信号処理が施された画像情報を記憶手段に記憶する処理である。

【0049】前記欠陥位置検出処理は、前記移動処理に

より前記固体撮像素子11を移動させながら、取り込んだ複数の画像情報をもとに前記固体撮像素子11の欠陥位置を検出する処理である。

【0050】図5に、前記欠陥位置検出処理の詳細を示す。図5に示したように、欠陥位置検出処理は、欠陥候補選定処理（ステップS51）、欠陥候補情報記憶処理（ステップS52）、欠陥位置決定処理（ステップS53）、欠陥位置記憶処理（ステップS54）を行う。

【0051】欠陥候補選定処理は、前記画像情報記憶処理の画像情報をもとに、前記固体撮像素子11の欠陥候補を選定する。欠陥候補情報記憶処理は、前記欠陥候補選定処理で選定した欠陥候補情報を記憶する。

【0052】欠陥位置決定処理は、前記欠陥候補情報記憶処理の欠陥候補情報をもとに、前記固体撮像素子11の欠陥位置を決定する。欠陥位置記憶処理は、前記欠陥位置決定処理で決定した前記固体撮像素子11の欠陥位置を記憶する。

【0053】また、本実施の形態においては、前記欠陥候補選定処理で選定した欠陥候補情報をもとに前記移動処理の移動方向および移動量を決定する移動量方向決定処理を行っている。

【0054】次に、図6～図10を参照しながら本発明の撮像装置および撮像方法を説明する。図6は、本実施の形態における撮像装置の要部構成を示すブロック図である。なお、図6において、図1と同一の構成については同一の符号を付して詳細な説明を省略している。

【0055】図6に示したように、本実施の形態の撮像装置は、欠陥補正手段218を具備し、欠陥画素を補正した画像を画像出力手段219に出力するようにしている。前記欠陥補正手段218は、第1および第2の画像記憶手段16a、16bに記憶された画像と、固体撮像素子11の欠陥画素の位置を記憶した欠陥位置記憶手段21に記憶された情報とをもとに、欠陥画素を補正する。

【0056】以下に、欠陥画素の補正方法を、図7を用いて説明する。図7は、5×5の受光素子をマトリクス状に配置した固体撮像素子11の出力を図示したもので、221、222は撮像素子の欠陥画素を示している。

【0057】取得した画像を補正することなく出力すると、欠陥画素221、222の位置に欠陥を生じた画像となる。そこで、図7（B）に示すように、例えば1画素分、固体撮像素子11を移動させて画像を取得すると、前画像よりも1画素分ずれた画像となる。

【0058】これらの2つの画像を図7（C）に示すように、一方の欠陥画素に他方の画素値を挿入することで、欠陥の無い画像（もとの欠陥位置を薄い網点で示した）を得ることができる。また、例えば欠陥の無い画素は、図7（A）と図7（B）との画素の平均値を出力することで、ランダムに生じるノイズを低減することがで

きる。ただし、ここでは図7（C）において、左端の1列の画素は、移動させたために対応する画素が存在しないので、そのまま画素値を出力することになる。

【0059】図8（A）に示すように欠陥画素が連続する場合は、図8（B）に示すように、連続する方向に固体撮像素子11を移動させると、図8（B）に示すように補正しきれない部分が生じる。しかし、図8（C）に示すように、欠陥画素と異なる方向に固体撮像素子11を移動させると、欠陥画素を補正することができる（もとの欠陥位置を薄い網点で示した）。

【0060】図6に示した移動量方向決定手段22は、欠陥位置記憶手段21に記憶された欠陥位置情報を元に固体撮像素子11の移動量および移動方向を決定する手段である。欠陥画素が経時的に変化することがないものは、移動方向および移動量をあらかじめ決定しておくことができるが、経時的に欠陥画素が生じる場合等は有効な手段として機能する。

【0061】また、欠陥画素が複数個点に在る場合は、移動後欠陥画素が他の欠陥画素に対応しないように移動方向および移動量を決定する。移動量方向決定手段22は移動制御手段13と結合しているとともに、欠陥補正手段218とも結合している。これは、移動方向および移動量によって対応させる画素が変わるためである。

【0062】本実施の形態の撮像装置は前述のようにして欠陥画素を補正するようにしたので、固体撮像素子11に欠陥画素があっても、それを良好に補正して欠陥の無い画像を出力することができる。

【0063】図9は、前述した撮像方法の手順を示すフローチャートである。図9に示したように、本実施の形態の撮像方法は、ステップS91で移動処理、ステップS92で撮像制御処理、ステップS93で信号処理を行い、ステップS94で画像情報記憶処理、ステップS95で欠陥位置検出処理、ステップS96で欠陥画素補正処理、ステップS97で欠陥補正した画像を表示する処理を行う。

【0064】前記移動処理は、複数の画素を有する固体撮像素子を所定方向に所定量だけ移動させる処理である。前記撮像制御処理は、前記移動処理によって移動される固体撮像素子の撮像動作を制御して複数の画像情報を生成させる撮像制御処理である。

【0065】前記信号処理は、前記固体撮像素子が出力する画像情報に所定の信号処理を施すステップである。前記画像情報記憶処理は、前記信号処理が出力した画像情報を記憶する処理である。

【0066】前記欠陥位置検出処理は、前記移動処理により前記固体撮像素子を移動させながら取り込んだ複数の画像情報をもとに前記固体撮像素子の欠陥位置を検出する処理である。

【0067】また、前記欠陥画素補正処理は、前記欠陥位置検出処理から出力される欠陥位置情報をもとに、前

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記固体撮像素子により生成された画像情報に基づいて欠陥画素を補正する処理である。

【0068】また、前記欠陥位置検出処理は、図10のフローチャートに示すように、4つのステップからなっている。すなわち、ステップS101で欠陥候補選定処理を行い、ステップS102で欠陥候補情報記憶処理を行い、ステップS103で欠陥位置決定処理を行い、ステップS104で欠陥位置記憶処理を行う。

【0069】前記欠陥候補選定処理は、前記画像情報記憶処理に記憶された画像情報をもとに、前記固体撮像素子の欠陥候補を選定する。そして、選定した欠陥候補情報をもとに前記移動処理の移動方向および移動量を決定する。前記欠陥候補情報記憶処理は、前記欠陥候補選定処理が選定した欠陥候補情報を記憶する。

【0070】（本発明の他の実施の形態）本発明は複数の機器（例えば、ホストコンピュータ、インタフェース機器、リーダ、プリンタ等）から構成されるシステムに適用しても1つの機器からなる装置に適用しても良い。

【0071】また、前述した実施の形態の機能を実現するように各種のデバイスを動作させるように、前記各種デバイスと接続された装置あるいはシステム内のコンピュータに対し、前記実施の形態の機能を実現するためのソフトウェアのプログラムコードを供給し、そのシステムあるいは装置のコンピュータ（CPUあるいはMPU）に格納されたプログラムに従って前記各種デバイスを動作させることによって実施したものも、本発明の範疇に含まれる。

【0072】また、この場合、前記ソフトウェアのプログラムコード自体が前述した実施の形態の機能を実現することになり、そのプログラムコード自体、およびそのプログラムコードをコンピュータに供給するための手段、例えばかかるプログラムコードを格納した記憶媒体は本発明を構成する。かかるプログラムコードを記憶する記憶媒体としては、例えばフロッピーディスク、ハードディスク、光ディスク、光磁気ディスク、CD-ROM、磁気テープ、不揮発性のメモ리카ード、ROM等を用いることができる。

【0073】また、コンピュータが供給されたプログラムコードを実行することにより、前述の実施の形態の機能が実現されるだけでなく、そのプログラムコードがコンピュータにおいて稼働しているOS（オペレーティングシステム）あるいは他のアプリケーションソフト等の共同して前述の実施の形態の機能が実現される場合にもかかるプログラムコードは本発明の実施の形態に含まれることは言うまでもない。

【0074】さらに、供給されたプログラムコードがコンピュータの機能拡張ボードやコンピュータに接続された機能拡張ユニットに備わるメモリに格納された後、そ

のプログラムコードの指示に基づいてその機能拡張ボードや機能拡張ユニットに備わるCPU等が実際の処理の一部または全部を行い、その処理によって前述した実施の形態の機能が実現される場合にも本発明に含まれることは言うまでもない。

【0075】

【発明の効果】以上説明したように、本発明の欠陥画素検出装置によれば、固体撮像素子を移動させながら複数の画像情報を取り込み、前記取り込んだ画像情報をもとに前記固体撮像素子の欠陥位置を検出するようにしたので、均一な光量の照明を使用することなく欠陥画素を検出することができ、欠陥画素検出装置の構成を簡素化できるとともに、正確な欠陥画素検出を行うことができる。

【0076】また、本発明の撮像装置によれば、複数の画素を有する固体撮像素子を所定方向に所定量だけ移動させながら取り込んだ複数の画像情報をもとにして前記固体撮像素子の欠陥位置を検出し、その検出結果に基づいて欠陥画素を補正するようにしたので、固体撮像素子に欠陥画素があっても良好に補正することが可能となり、欠陥の無い高品質の画像を出力することができる。

【図面の簡単な説明】

【図1】本発明の欠陥画素検出装置の実施の形態を示す構成図である。

【図2】欠陥画素の検出方法の説明図である。

【図3】固体撮像素子の移動方向を説明する図である。

【図4】欠陥画素検出方法の一例を示すフローチャートである。

【図5】欠陥位置検出処理を説明するフローチャートである。

【図6】本発明の撮像装置の実施の形態を示す構成図である。

【図7】欠陥画素の検出方法の説明図である。

【図8】固体撮像素子の移動方向を説明する図である。

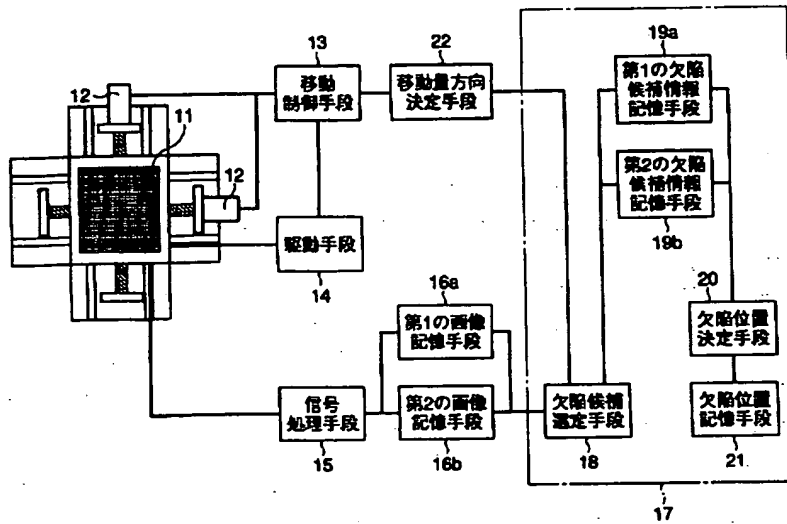
【図9】欠陥画素補正方法の一例を示すフローチャートである。

【図10】欠陥位置検出処理を説明するフローチャートである。

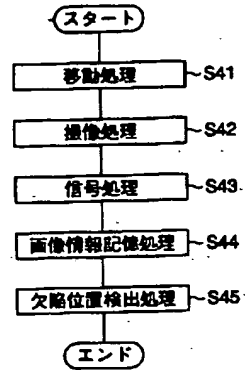
【符号の説明】

- 11 固体撮像素子
- 12 移動手段
- 13 移動制御手段
- 14 駆動手段
- 15 信号処理手段
- 16 画像記憶手段
- 17 欠陥画素検出手段
- 18 欠陥候補選定手段

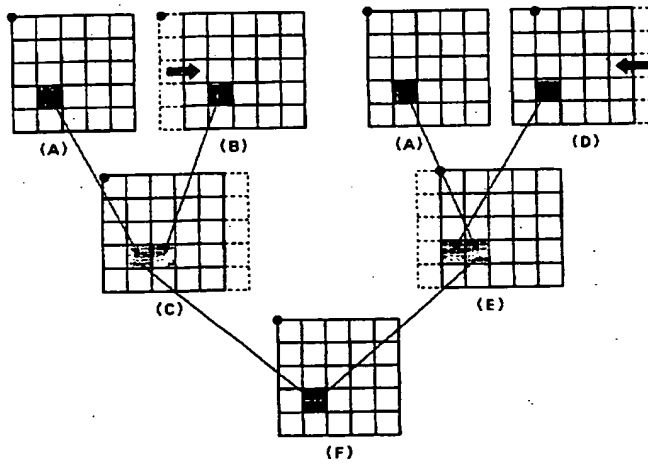
【図1】



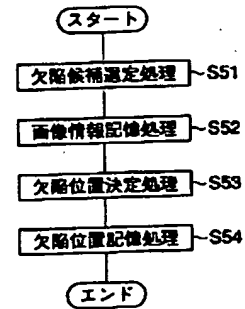
【図4】



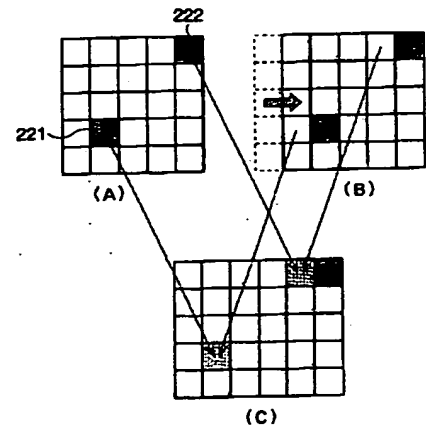
【図2】



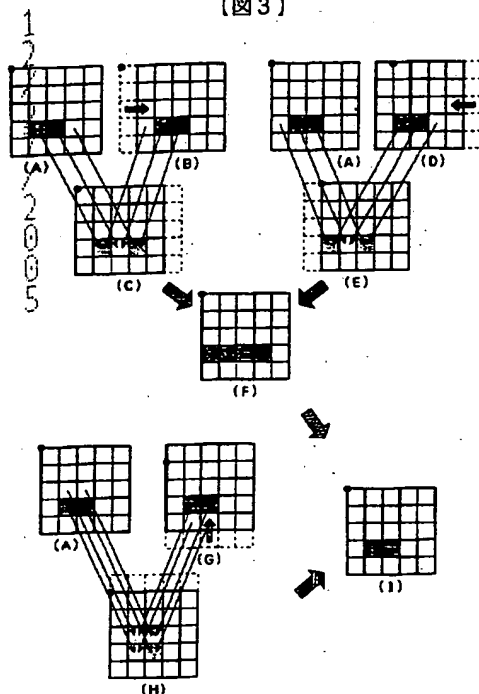
【図5】



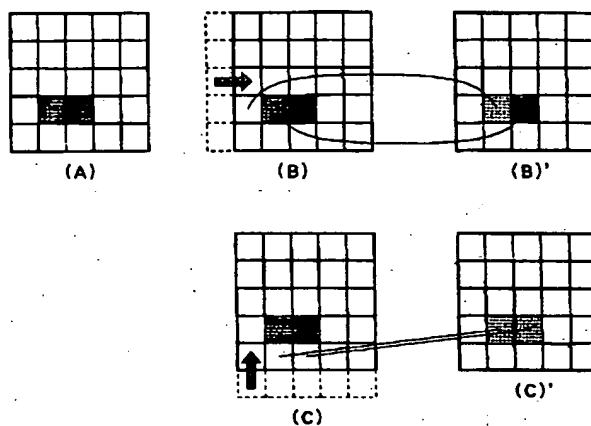
【図7】



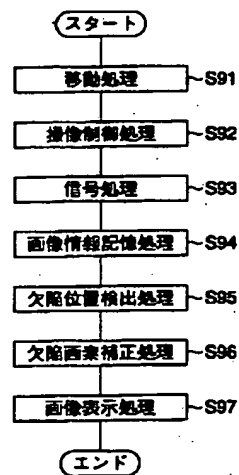
【図3】



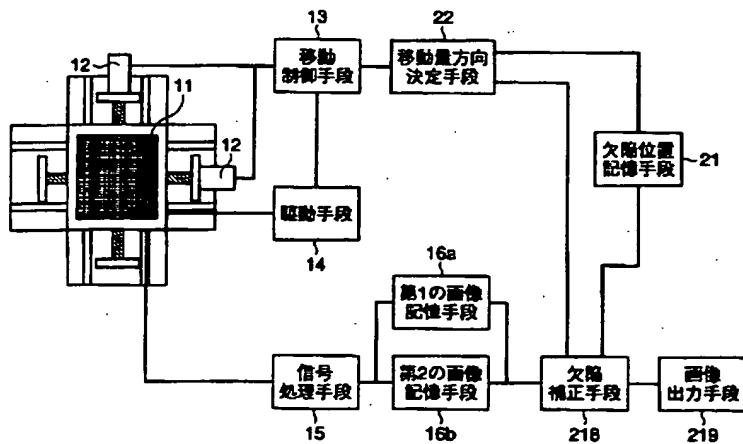
【図8】



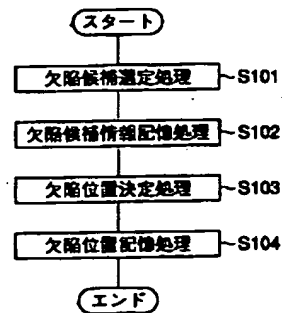
【図9】



【図6】



【図10】



*** NOTICES ***

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- 1.This document has been translated by computer. So the translation may not reflect the original precisely.
- 2.**** shows the word which can not be translated.
- 3.In the drawings, any words are not translated.

DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001]

[Field of the Invention] Especially this invention relates to the equipment which detects the location of the defective pixel of the solid state image sensor which has a defective pixel, and the equipment which detects the location of the unique defective pixel of an optical response about defective pixel detection equipment, the defective pixel detection approach, the image pick-up approach, image pick-up equipment, and a storage.

[0002]

[Description of the Prior Art] Solid state image sensors, such as CCD used for a video camera, an electronic "still" camera, etc., produce two or more defective pixels in the manufacture process. Therefore, he permutes the output of a defective pixel by the front-end pixel, or was trying to output the image which permutes by the average which is the perimeter pixel which a defective pixel touches, and does not have a defect.

[0003] There are a white defect which produces a flake since the response of the dark current is mainly higher than the pixel of the perimeter, a black defect which produces a sunspot since the optical response of a pixel is lower than the pixel of the perimeter as these defects.

[0004] Before, for detection of these defective pixel, the pixel which outputs unique level to the average value of the inside of a solid state image sensor or a circumference pixel to the value as compared with the threshold which gave fixed width of face was detected as a defective pixel.

[0005]

[Problem(s) to be Solved by the Invention] By the above detection approaches of a defective pixel, in order to detect a defect with an optical unique response, when the lighting of the uniform quantity of light was needed and abnormalities, such as spots, arose for the lighting, in spite of having been a normal pixel, it might be judged with the defect.

[0006] This invention aims at enabling it to detect a defective pixel with high precision in view of the above-mentioned trouble, without using the lighting of the uniform quantity of light.

[0007]

[Means for Solving the Problem] In order to attain said purpose, the defective pixel detection equipment in connection with this invention A migration means by which are defective pixel detection equipment which detects the defective pixel of the solid state image sensor which has two or more pixels, and only the specified quantity moves said solid state image sensor in the predetermined direction, It is characterized by having the image pick-up control means which image pick-up actuation of said solid state image sensor is controlled [control means], and makes image information generate, and a defective location detection means to detect the defective location of said solid state image sensor based on the image information outputted from said solid state image sensor.

[0008] Moreover, the place by which it is characterized [of the defective pixel detection equipment of this invention / other] A migration means by which are defective pixel detection equipment which detects the defective pixel of the solid state image sensor which has two or more pixels, and only the specified quantity moves said solid state image sensor in the predetermined direction, The image pick-up control means which image pick-up actuation of the

solid state image sensor moved by said migration means is controlled [control means], and makes two or more image information generate, A signal-processing means to process two or more image information which said solid state image sensor outputs, It is characterized by having an image information storage means to memorize the image information outputted from said signal-processing means, and a defective location detection means to detect the defective location of said solid state image sensor based on two or more image information read from said image information storage means.

[0009] Moreover, the place by which it is characterized [of the defective pixel detection equipment of this invention / other] A defective candidate selection means to select the defective candidate of said solid state image sensor based on the image information said defective location detection means was remembered to be by said image information storage means, A defective candidate information storage means to memorize the defective candidate information which said defective candidate selection means selected, It is characterized by having the defective positioning means which determines the defective location of said solid state image sensor, and a defective position-memory means to memorize the defective location of said solid state image sensor which said defective positioning means determined, based on the defective candidate information on said defective candidate information storage means.

[0010] Moreover, the place by which it is characterized [of the defective pixel detection equipment of this invention / other] is characterized by having a movement magnitude direction decision means to determine the migration direction and movement magnitude of said migration means based on the defective candidate information which said defective candidate selection means selected.

[0011] Moreover, the solid state image sensor with which the image pick-up equipment of this invention has two or more pixels and a migration means by which only the specified quantity moves said solid state image sensor in the predetermined direction, The image pick-up control means which image pick-up actuation of the solid state image sensor moved by said migration means is controlled [control means], and makes image information generate, A defective location detection means to detect the defective location of said solid state image sensor based on two or more image information incorporated while moving said solid state image sensor with said migration means, and to output defective positional information, It is characterized by having a defective pixel amendment means to amend a defective pixel based on the image information generated by said solid state image sensor, based on the defective positional information outputted from said defective location detection means.

[0012] Moreover, the place by which it is characterized [of the image pick-up equipment of this invention / other] The solid state image sensor which has two or more pixels, and a migration means by which only the specified quantity moves said solid state image sensor in the predetermined direction, The image pick-up control means which image pick-up actuation of the solid state image sensor moved by said migration means is controlled [control means], and makes two or more image information generate, A signal-processing means to process the image information which said solid state image sensor outputs, and an image information storage means to memorize the image information which said signal-processing means outputted, A defective location detection means to detect the defective location of said solid state image sensor based on two or more image information incorporated while moving said solid state image sensor with said migration means, It is characterized by having a defective pixel amendment means to amend a defective pixel based on the image information generated by said solid state image sensor, based on the defective positional information outputted from said defective location detection means.

[0013] Moreover, the place by which it is characterized [of others of the image pick-up equipment of this invention] A defective candidate selection means to select the defective candidate of said solid state image sensor based on the image information said defective location detection means was remembered to be by said image information storage means, A defective candidate information storage means to memorize the defective candidate information which said defective candidate selection means selected, It is characterized by having the defective positioning means which determines the defective location of said solid state image sensor, and

a defective position-memory means to memorize the defective location of said solid state image sensor which said defective positioning means determined, based on the defective candidate information on said defective candidate information storage means.

[0014] Moreover, the place by which it is characterized [of others of the image pick-up equipment of this invention] is characterized by having a movement magnitude direction decision means to determine the migration direction and movement magnitude of said migration means based on the defective candidate information which said defective candidate selection means selected.

[0015] Moreover, the place by which it is characterized [of the defective pixel detection approach of this invention] The migration processing for which is the defective pixel detection approach using the solid state image sensor which has two or more pixels, and only the specified quantity moves said solid state image sensor in the predetermined direction, Image pick-up control processing in which control image pick-up actuation of the solid state image sensor moved by said migration processing, and two or more image information is made to generate, It is characterized by performing defective location detection processing in which the defective location of said solid state image sensor is detected based on two or more image information generated by said image pick-up control processing.

[0016] Moreover, the place by which it is characterized [of the defective pixel detection approach of this invention / other] The migration processing for which is the defective pixel detection approach using the solid state image sensor which has two or more pixels, and only the specified quantity moves said solid state image sensor in the predetermined direction, The image pick-up processing which controls image pick-up actuation of said solid state image sensor, and signal processing which processes the image information which said solid state image sensor outputs, It is characterized by performing image information storage processing in which said image information by which signal processing was carried out is memorized, and defective location detection processing in which the defective location of said solid state image sensor is detected based on two or more incorporated image information while moving said solid state image sensor by said migration processing.

[0017] Moreover, the place by which it is characterized [of others of the defective pixel detection approach of this invention] The defective candidate selection processing in which said defective location detection processing selects the defective candidate of said solid state image sensor based on the image information of said image information storage processing, Defective candidate information memory processing which memorizes the defective candidate information which said defective candidate selection processing selected, It is characterized by performing defective spotting processing in which the defective location of said solid state image sensor is determined, and defective position-memory processing in which the defective location of said solid state image sensor which said defective spotting processing determined is memorized, based on the defective candidate information on said defective candidate information memory processing.

[0018] Moreover, the place by which it is characterized [of others of the defective pixel detection approach of this invention] is characterized by having the movement magnitude direction decision processing in which the migration direction and movement magnitude of said migration processing are determined based on the defective candidate information which said defective candidate selection processing selected.

[0019] Moreover, the place by which it is characterized [of the image pick-up approach of this invention] The migration processing for which only the specified quantity moves the solid state image sensor which has two or more pixels in the predetermined direction, Image pick-up control processing in which control image pick-up actuation of the solid state image sensor moved by said migration processing, and image information is made to generate, The defective location detection processing which detects the defective location of said solid state image sensor based on two or more image information incorporated while moving said solid state image sensor by said migration processing, and outputs defective positional information, It is characterized by performing defective pixel amendment processing which amends a defective pixel based on the image information generated by said solid state image sensor based on the defective positional

information outputted from said defective location detection processing.

[0020] Moreover, the place by which it is characterized [of the image pick-up approach of this invention / other] The solid state image sensor which has two or more pixels, and the migration processing for which only the specified quantity moves said solid state image sensor in the predetermined direction, Image pick-up control processing in which control image pick-up actuation of the solid state image sensor moved by said migration processing, and two or more image information is made to generate, Signal processing which processes the image information which said solid state image sensor outputs, and image information storage processing in which the image information which said signal processing outputted is memorized, Defective location detection processing in which the defective location of said solid state image sensor is detected based on two or more image information incorporated while moving said solid state image sensor by said migration processing, It is characterized by performing defective pixel amendment processing which amends a defective pixel based on the image information generated by said solid state image sensor based on the defective positional information outputted from said defective location detection processing.

[0021] Moreover, the place by which it is characterized [of the image pick-up approach of this invention / other] The defective candidate selection processing which selects the defective candidate of said solid state image sensor based on the image information said defective location detection processing was remembered to be by said image information storage processing, Defective candidate information memory processing which memorizes the defective candidate information which said defective candidate selection processing selected, It is characterized by performing defective spotting processing in which the defective location of said solid state image sensor is determined, and defective position-memory processing in which the defective location of said solid state image sensor which said defective spotting processing determined is memorized, based on the defective candidate information on said defective candidate information memory processing.

[0022] Moreover, the place by which it is characterized [of the image pick-up approach of this invention / other] is characterized by performing the movement magnitude direction decision processing in which the migration direction and movement magnitude of said migration processing are determined based on the defective candidate information which said defective candidate selection processing selected.

[0023] Moreover, the place by which it is characterized [of the storage of this invention] is characterized by storing the program for making it function on a computer as said each means.

[0024] Moreover, the place by which it is characterized [of the storage of this invention / other] is characterized by storing the program for making a computer perform the procedure of said the processing of each.

[0025]

[Embodiment of the Invention] Below, the gestalt of operation of this invention is explained at a detail, referring to an accompanying drawing. Drawing 1 is the block diagram of the defective pixel detection equipment of this invention. As shown in drawing 1, the solid state image sensor 11 to be examined consists of a photo detector arranged in the shape of [two or more] a matrix, and is arranged on the migration means 12.

[0026] As for the migration means 12, the actuation is controlled by the migration control means 13, and drive control of the solid state image sensor 11 is carried out by the driving means 14.

[0027] It is made to combine also with the migration control means 13, and the driving means 14 is planning timing of a drive and migration. Said migration means 12 has structure to which the table which was made to drive a ball screw with SUTTEPPINGUMOTA or a servo motor, and fixed the solid state image sensor 11 is moved.

[0028] And with the signal-processing means 15, analog-to-digital (A/D) conversion is carried out, and the signal outputted from a solid state image sensor 11 is memorized by 1st image storage means 16a and 2nd image storage means 16b for every photography, respectively. In addition, with the gestalt of this operation, although two image storage means are illustrated, there should just be a predetermined capacity which does not limit to this number, of course and can memorize two or more images. These 1st and 2nd image storage means 16a and 16b are

specifically storages in which a read and write like RAM or HD is possible.

[0029] A defective pixel detection means 17 to detect the defective pixel of a solid state image sensor 11 is set to the defective candidate selection means 18, and 1st defective candidate information storage means 19a and 2nd defective candidate information storage means 19b from the defective positioning means 20 and the defective position-memory means 21. Here, the defective pixel detection means 17 which consists of these is explained.

[0030] The defective candidate selection means 18 compares the image memorized by the 1st above-mentioned image storage means 16a and 2nd image storage means 16b for every pixel which corresponds, respectively, and selects the defective pixel candidate of a solid state image sensor 11.

[0031] The operation output outputted in this selection process is memorized by 1st defective candidate information storage means 19a and 2nd defective candidate information storage means 19b. The defective positioning means 20 is measuring every [/ based on the defective candidate information memorized by 1st defective candidate information storage means 19a and 2nd defective candidate information storage means 19b, respectively] pixel, respectively, and determines the location of a defective pixel.

[0032] The location of the defective pixel determined here is memorized by the defective position-memory means 21. The defective positional information memorized by this defective position-memory means 21 can also be outputted to output units, such as for example, ROM baking equipment.

[0033] Here, the detection approach of a defective pixel is explained in detail using drawing 2. Drawing 2 (A) is a thing illustrating the output of the solid state image sensor 11 which has arranged the photo detector of 5x5 in the shape of a matrix, and the halftone dot section in drawing 2 shows the output of the defective pixel of a solid state image sensor 11.

[0034] Here, although the halftone dot shows the defective pixel in order to give explanation easy, the location of a defective pixel is not known in fact at this time. This output image is saved at 1st image storage means 16a. Incidentally, an upper left sunspot is described in order to make the zero of an image easy to understand.

[0035] Next, if 1 pixel and a solid state image sensor 11 are moved to the right and an image is acquired as shown in drawing 2 (B) for example, it will become the image which shifted by 1 pixel on the right of the coordinate of drawing 2 (A). This image is saved similarly at 2nd image storage means 16b. If difference is taken for every pixel which corresponds these two images, as shown in drawing 2 (C), the image which shows a unique value to the location of the pixel corresponding to a defective pixel will be obtained. This image is saved at 1st defective candidate information storage means 19a.

[0036] If a solid state image sensor 11 is moved to the left by 1 pixel and an image is shortly acquired as shown in drawing 2 (D) for example, it will become the image which shifted by 1 pixel on the left of the coordinate of drawing 2 (A). This image is overwritten at 2nd image storage means 16b.

[0037] If difference is taken for every pixel which corresponds this image and the image of already acquired drawing 2 (A), as shown in drawing 2 (E), the image which shows a unique value to the location of the pixel corresponding to a defective pixel will be obtained. This image is saved at 2nd defective candidate information storage means 19b.

[0038] If an AND is taken for every image saved at 1st defective candidate information storage means 19a and 2nd defective candidate information storage means 19b, and image which corresponds drawing 2 (C) and (E) here, a defective pixel is detectable as shown in drawing 2 (F). The location of the detected defect is memorized by the defective position-memory means 21.

[0039] Moreover, a value unique [when a solid state image sensor 11 is moved in the direction in which a defective pixel continues as it is shown in drawing 3 (B), when a defective pixel exists continuously, as shown in drawing 3 (A) for example, as shown in drawing 3 (C), the halftone dot section shows a unique value, but] since the pixel in the meantime took the difference of defective pixel values may not be shown.

[0040] Moreover, since the difference of defective pixel values was taken as shown in drawing 3 (E) also when it was made to move to hard flow as shown in drawing 3 (D), similarly a unique

value may not be shown. The location of a defective pixel cannot be pinpointed at all for the AND of drawing 3 (C) and drawing 3 (E).

[0041] Then, an OR is taken and it saves at 1st defective candidate information storage means 19a as a defective pixel candidate image as shown in drawing 3 (F).

[0042] Next, as drawing 3 (B) and drawing 3 (D) are moved in the different direction, and are shown in drawing 3 (G) and it is shown in drawing 2 (H) when difference is taken for every pixel which corresponds this image and the image of already acquired drawing 2 (A), the image which shows a unique value to the location of the pixel corresponding to a defective pixel is obtained.

[0043] If an AND with drawing 3 (F) which saved this image and point is taken, a defective pixel can be determined as shown in drawing 3 (I). Thus, the movement magnitude direction decision means 22 is a means to determine the migration direction and movement magnitude that there are no detection remnants based on the defective candidate information detected by each processing. It combines also with the migration control means 13, and the movement magnitude direction decision means 22 specifies movement magnitude and a direction while having combined with the defective candidate selection means 18.

[0044] Although the above explanation did not describe especially the count that acquires each image, the effect of random noise can be reduced by carrying out multiple-times acquisition also with each image, of course, and processing using the equalized image.

[0045] Moreover, it is also possible to build this equipment into photography equipments, such as a video camera, and to use as equipment which detects the defective pixel produced after that, although it was not a defective pixel at the time of shop inspection.

[0046] Drawing 4 is a flow chart which shows the procedure of the defective pixel detection approach mentioned above. As shown in drawing 4, the defective pixel detection approach of the gestalt this operation performs migration processing at step S41, performs image pick-up processing at step S42, performs signal processing at step S43, performs image information storage processing at step S44, and performs defective location detection processing at step S45.

[0047] Said migration processing is processing for which only the specified quantity moves said solid state image sensor 11 in the predetermined direction. Moreover, said image pick-up processing is processing which controls image pick-up actuation of said solid state image sensor 11, and acquires image information.

[0048] Said signal processing is processing which performs predetermined signal processing to the image information which said solid state image sensor 11 outputs. Said image information storage processing is processing which memorizes the image information to which said signal processing was performed for a storage means.

[0049] Said defective location detection processing is processing which detects the defective location of said solid state image sensor 11 based on two or more incorporated image information, moving said solid state image sensor 11 by said migration processing.

[0050] The detail of said defective location detection processing is shown in drawing 5. As shown in drawing 5, defective location detection processing performs defective candidate selection processing (step S51), defective candidate information memory processing (step S52), defective spotting processing (step S53), and defective position-memory processing (step S54).

[0051] Defective candidate selection processing selects the defective candidate of said solid state image sensor 11 based on the image information of said image information storage processing. Defective candidate information memory processing memorizes the defective candidate information selected by said defective candidate selection processing.

[0052] Defective spotting processing determines the defective location of said solid state image sensor 11 based on the defective candidate information on said defective candidate information memory processing. Defective position-memory processing memorizes the defective location of said solid state image sensor 11 determined by said defective spotting processing.

[0053] Moreover, in the gestalt of this operation, the movement magnitude direction decision processing in which the migration direction and movement magnitude of said migration processing are determined based on the defective candidate information selected by said defective candidate selection processing is performed.

[0054] Next, the image pick-up equipment and the image pick-up approach of this invention are explained, referring to drawing 6 - drawing 10. Drawing 6 is the block diagram showing the important section configuration of the image pick-up equipment in the gestalt of this operation. In addition, in drawing 6, the sign same about the same configuration as drawing 1 is attached, and detailed explanation is omitted.

[0055] The image pick-up equipment of the gestalt of this operation possesses the defective amendment means 218, and he is trying to output the image which amended the defective pixel to the image output means 219, as shown in drawing 6. Said defective amendment means 218 amends a defective pixel based on the image memorized by the 1st and 2nd image storage means 16a and 16b and the information memorized by defective position-memory means 21 by which the location of the defective pixel of a solid state image sensor 11 was memorized.

[0056] Drawing 7 is used for below and the amendment approach of a defective pixel is explained to it. Drawing 7 is a thing illustrating the output of the solid state image sensor 11 which has arranged the photo detector of 5x5 in the shape of a matrix, and 221 and 222 show the defective pixel of an image sensor.

[0057] If it outputs without amending the acquired image, it will become the image which produced the defect in the location of the defective pixels 221 and 222. Then, if 1 pixel and a solid state image sensor 11 are moved and an image is acquired as shown in drawing 7 (B) for example, it will become the image by 1 pixel deviated from a front image.

[0058] An image (the thin halftone dot showed the defective location of a basis) without a defect can be obtained by inserting the pixel value of another side in one defective pixel for these two images, as shown in drawing 7 (C). moreover -- for example, the pixel without a defect can reduce the noise produced at random with outputting the average of the pixel of drawing 7 (A) and drawing 7 (B). However, in drawing 7 (C), since it was made to move and a pixel does not exist, the pixel of a left end single tier will output a pixel value as it is here.

[0059] If a solid state image sensor 11 is moved in the continuous direction as shown in drawing 8 (B) when a defective pixel continues, as shown in drawing 8 (A), the part which cannot be amended as shown in drawing 8 (B) will arise. However, a defective pixel can be amended, if a solid state image sensor 11 is moved in the different direction from a defective pixel as shown in drawing 8 (C) (the thin halftone dot showed the defective location of a basis).

[0060] The movement magnitude direction decision means 22 shown in drawing 6 is a means to determine the movement magnitude and the migration direction of a solid state image sensor 11 based on the defective positional information memorized by the defective position-memory means 21. Although that from which a defective pixel does not change with time can determine the migration direction and movement magnitude beforehand, when a defective pixel arises with time, it functions as an effective means.

[0061] Moreover, when dotted with two or more defective pixels, the defective pixel after migration determines that the migration direction and movement magnitude will not correspond to other defective pixels. The movement magnitude direction decision means 22 is combined also with the defective amendment means 218 while having combined with the migration control means 13. This is for the pixel to which it is made to correspond with the migration direction and movement magnitude to change.

[0062] Since the image pick-up equipment of the gestalt of this operation amended the defective pixel as mentioned above, even if a defective pixel is in a solid state image sensor 11, the image which amends it good and does not have a defect can be outputted.

[0063] Drawing 9 is a flow chart which shows the procedure of the image pick-up approach mentioned above. As shown in drawing 9, the image pick-up approach of the gestalt this operation carries out the processing which displays in the image which performed image pick-up control processing at migration processing and step S92, and it performed signal processing at step S93 by step S91, and carried out at image-information storage processing and step S95 by step S94, and carried out [approach] defective amendment at defective pixel amendment processing and step S97 in defective location detection processing and step S96.

[0064] Said migration processing is processing for which only the specified quantity moves the solid state image sensor which has two or more pixels in the predetermined direction. Said image

pick-up control processing is image pick-up control processing in which control image pick-up actuation of the solid state image sensor moved by said migration processing, and two or more image information is made to generate.

[0065] Said signal processing is a step which performs predetermined signal processing to the image information which said solid state image sensor outputs. Said image information storage processing is processing which memorizes the image information which said signal processing outputted.

[0066] Said defective location detection processing is processing which detects the defective location of said solid state image sensor based on two or more image information incorporated while moving said solid state image sensor by said migration processing.

[0067] Moreover, said defective pixel amendment processing is processing which amends a defective pixel based on the image information generated by said solid state image sensor based on the defective positional information outputted from said defective location detection processing.

[0068] Moreover, said defective location detection processing consists of four steps, as shown in the flow chart of drawing 10. That is, defective candidate selection processing is performed at step S101, defective candidate information memory processing is performed at step S102, defective spotting processing is performed at step S103, and defective position-memory processing is performed at step S104.

[0069] Said defective candidate selection processing selects the defective candidate of said solid state image sensor based on the image information memorized by said image information storage processing. And the migration direction and movement magnitude of said migration processing are determined based on the selected defective candidate information. Said defective candidate information memory processing memorizes the defective candidate information which said defective candidate selection processing selected.

[0070] (Gestalt of other operations of this invention) Even if it applies this invention to the system which consists of two or more devices (for example, a host computer, an interface device, a reader, a printer, etc.), it may be applied to the equipment which consists of one device.

[0071] Moreover, so that the function of the gestalt of operation mentioned above may be realized and various kinds of devices may be operated As opposed to the computer in the equipment connected with said various devices, or a system The program code of the software for realizing the function of the gestalt of said operation is supplied. What was carried out by operating said various devices according to the program stored in the computer (CPU or MPU) of the system or equipment is contained under the category of this invention.

[0072] Moreover, the function of the gestalt of operation which the program code of said software itself mentioned above in this case will be realized, and the storage which stored the means for supplying that program code itself and its program code to a computer, for example, this program code, constitutes this invention. As a storage which memorizes this program code, a floppy disk, a hard disk, an optical disk, a magneto-optic disk, CD-ROM, a magnetic tape, the memory card of a non-volatile, ROM, etc. can be used, for example.

[0073] Moreover, by performing the program code with which the computer was supplied, also when [, such as OS (operating system) or other application software with which the function of the gestalt of the above-mentioned operation is not only realized, but the program code is working in a computer,] the function of the gestalt of the above-mentioned operation is realized jointly, it cannot be overemphasized that this program code is contained in the gestalt of operation of this invention.

[0074] Furthermore, after stored in the memory with which the functional expansion unit by which the supplied program code was connected to the functional add-in board and the computer of a computer is equipped, also when the function of the gestalt of operation which performed a part or all of processing that CPU with which the functional add-in board and functional expansion unit are equipped based on directions of the program code is actual, and mentioned above by the processing is realized, it cannot be overemphasized that it is contained in this invention.

[0075]

[Effect of the Invention] Since according to the defective pixel detection equipment of this invention two or more image information is incorporated and the defective location of said solid state image sensor was detected based on said incorporated image information, moving a solid state image sensor, as explained above, while being able to detect a defective pixel and being able to simplify the configuration of defective pixel detection equipment, without using the lighting of the uniform quantity of light, exact defective pixel detection can be performed.

[0076] Moreover, since according to the image pick-up equipment of this invention the defective location of said solid state image sensor is detected based on two or more image information incorporated while only the specified quantity moved the solid state image sensor which has two or more pixels in the predetermined direction and the defective pixel was amended based on the detection result, even if a defective pixel is in a solid state image sensor, it becomes possible to amend good, and the image of high quality without a defect can be outputted.

[Translation done.]

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CLAIMS**[Claim(s)]**

[Claim 1] The defective pixel detection equipment characterized by to have a migration means to by which are defective pixel detection equipment which detects the defective pixel of the solid state image sensor which has two or more pixels, and only the specified quantity moves said solid state image sensor in the predetermined direction, the image pick-up control means which image pick-up actuation of said solid state image sensor controls [control means], and make image information generate, and a defective location detection means detect the defective location of said solid state image sensor based on the image information outputted from said solid state image sensor.

[Claim 2] A migration means by which are defective pixel detection equipment which detects the defective pixel of the solid state image sensor which has two or more pixels, and only the specified quantity moves said solid state image sensor in the predetermined direction, The image pick-up control means which image pick-up actuation of the solid state image sensor moved by said migration means is controlled [control means], and makes two or more image information generate, A signal-processing means to process two or more image information which said solid state image sensor outputs, Defective pixel detection equipment characterized by having an image information storage means to memorize the image information outputted from said signal-processing means, and a defective location detection means to detect the defective location of said solid state image sensor based on two or more image information read from said image information storage means.

[Claim 3] A defective candidate selection means to select the defective candidate of said solid state image sensor based on the image information said defective location detection means was remembered to be by said image information storage means, A defective candidate information storage means to memorize the defective candidate information which said defective candidate selection means selected, The defective positioning means which determines the defective location of said solid state image sensor based on the defective candidate information on said defective candidate information storage means, Defective pixel detection equipment according to claim 2 characterized by having a defective position-memory means to memorize the defective location of said solid state image sensor which said defective positioning means determined.

[Claim 4] Defective pixel detection equipment according to claim 3 characterized by having a movement magnitude direction decision means to determine the migration direction and movement magnitude of said migration means based on the defective candidate information which said defective candidate selection means selected.

[Claim 5] The solid state image sensor which has two or more pixels, and a migration means by which only the specified quantity moves said solid state image sensor in the predetermined direction, The image pick-up control means which image pick-up actuation of the solid state image sensor moved by said migration means is controlled [control means], and makes image information generate, A defective location detection means to detect the defective location of said solid state image sensor based on two or more image information incorporated while moving said solid state image sensor with said migration means, and to output defective positional information, Image pick-up equipment characterized by having a defective pixel amendment

means to amend a defective pixel based on the image information generated by said solid state image sensor, based on the defective positional information outputted from said defective location detection means.

[Claim 6] The solid state image sensor which has two or more pixels, and a migration means by which only the specified quantity moves said solid state image sensor in the predetermined direction. The image pick-up control means which image pick-up actuation of the solid state image sensor moved by said migration means is controlled [control means], and makes two or more image information generate. A signal-processing means to process the image information which said solid state image sensor outputs, and an image information storage means to memorize the image information which said signal-processing means outputted. A defective location detection means to detect the defective location of said solid state image sensor based on two or more image information incorporated while moving said solid state image sensor with said migration means. Image pick-up equipment characterized by having a defective pixel amendment means to amend a defective pixel based on the image information generated by said solid state image sensor, based on the defective positional information outputted from said defective location detection means.

[Claim 7] A defective candidate selection means to select the defective candidate of said solid state image sensor based on the image information said defective location detection means was remembered to be by said image information storage means. A defective candidate information storage means to memorize the defective candidate information which said defective candidate selection means selected. Image pick-up equipment according to claim 6 characterized by having the defective positioning means which determines the defective location of said solid state image sensor, and a defective position-memory means to memorize the defective location of said solid state image sensor which said defective positioning means determined, based on the defective candidate information on said defective candidate information storage means.

[Claim 8] Image pick-up equipment according to claim 7 characterized by having a movement magnitude direction decision means to determine the migration direction and movement magnitude of said migration means based on the defective candidate information which said defective candidate selection means selected.

[Claim 9] The migration processing for which is the defective pixel detection approach using the solid state image sensor which has two or more pixels, and only the specified quantity moves said solid state image sensor in the predetermined direction. Image pick-up control processing in which control image pick-up actuation of the solid state image sensor moved by said migration processing, and two or more image information is made to generate. The defective pixel detection approach characterized by performing defective location detection processing in which the defective location of said solid state image sensor is detected based on two or more image information generated by said image pick-up control processing.

[Claim 10] The migration processing for which is the defective pixel detection approach using the solid state image sensor which has two or more pixels, and only the specified quantity moves said solid state image sensor in the predetermined direction. The image pick-up processing which controls image pick-up actuation of said solid state image sensor, and signal processing which processes the image information which said solid state image sensor outputs. The defective pixel detection approach characterized by performing image information storage processing in which said image information by which signal processing was carried out is memorized, and defective location detection processing in which the defective location of said solid state image sensor is detected based on two or more incorporated image information while moving said solid state image sensor by said migration processing.

[Claim 11] The defective candidate selection processing in which said defective location detection processing selects the defective candidate of said solid state image sensor based on the image information of said image information storage processing. Defective candidate information memory processing which memorizes the defective candidate information which said defective candidate selection processing selected. Defective spotting processing in which the defective location of said solid state image sensor is determined based on the defective candidate information on said defective candidate information memory processing. The defective

pixel detection approach according to claim 10 characterized by performing defective position-memory processing in which the defective location of said solid state image sensor which said defective spotting processing determined is memorized.

[Claim 12] The defective pixel detection approach according to claim 11 characterized by having the movement magnitude direction decision processing in which the migration direction and movement magnitude of said migration processing are determined based on the defective candidate information which said defective candidate selection processing selected.

[Claim 13] The migration processing for which only the specified quantity moves the solid state image sensor which has two or more pixels in the predetermined direction, Image pick-up control processing in which control image pick-up actuation of the solid state image sensor moved by said migration processing, and image information is made to generate, The defective location detection processing which detects the defective location of said solid state image sensor based on two or more image information incorporated while moving said solid state image sensor by said migration processing, and outputs defective positional information, The image pick-up approach characterized by performing defective pixel amendment processing which amends a defective pixel based on the image information generated by said solid state image sensor based on the defective positional information outputted from said defective location detection processing.

[Claim 14] The solid state image sensor which has two or more pixels, and the migration processing for which only the specified quantity moves said solid state image sensor in the predetermined direction, Image pick-up control processing in which control image pick-up actuation of the solid state image sensor moved by said migration processing, and two or more image information is made to generate, Signal processing which processes the image information which said solid state image sensor outputs, and image information storage processing in which the image information which said signal processing outputted is memorized, Defective location detection processing in which the defective location of said solid state image sensor is detected based on two or more image information incorporated while moving said solid state image sensor by said migration processing, The image pick-up approach characterized by performing defective pixel amendment processing which amends a defective pixel based on the image information generated by said solid state image sensor based on the defective positional information outputted from said defective location detection processing.

[Claim 15] The defective candidate selection processing which selects the defective candidate of said solid state image sensor based on the image information said defective location detection processing was remembered to be by said image information storage processing, Defective candidate information memory processing which memorizes the defective candidate information which said defective candidate selection processing selected, The image pick-up approach according to claim 14 characterized by performing defective spotting processing in which the defective location of said solid state image sensor is determined, and defective position-memory processing in which the defective location of said solid state image sensor which said defective spotting processing determined is memorized, based on the defective candidate information on said defective candidate information memory processing.

[Claim 16] The image pick-up approach according to claim 15 characterized by performing the movement magnitude direction decision processing in which the migration direction and movement magnitude of said migration processing are determined based on the defective candidate information which said defective candidate selection processing selected.

[Claim 17] The storage characterized by storing the program for making it function on a computer as each means of a publication in any 1 term of claims 1-8.

[Claim 18] The storage characterized by storing the program for making a computer perform the procedure of each processing of a publication in any 1 term of claims 9-16.

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DESCRIPTION OF DRAWINGS**[Brief Description of the Drawings]**

[Drawing 1] It is the block diagram showing the gestalt of operation of the defective pixel detection equipment of this invention.

[Drawing 2] It is the explanatory view of the detection approach of a defective pixel.

[Drawing 3] It is drawing explaining the migration direction of a solid state image sensor.

[Drawing 4] It is the flow chart which shows an example of the defective pixel detection approach.

[Drawing 5] It is a flow chart explaining defective location detection processing.

[Drawing 6] It is the block diagram showing the gestalt of operation of the image pick-up equipment of this invention.

[Drawing 7] It is the explanatory view of the detection approach of a defective pixel.

[Drawing 8] It is drawing explaining the migration direction of a solid state image sensor.

[Drawing 9] It is the flow chart which shows an example of the defective pixel amendment approach.

[Drawing 10] It is a flow chart explaining defective location detection processing.

[Description of Notations]

- 11 Solid State Image Sensor
- 12 Migration Means
- 13 Migration Control Means
- 14 Driving Means
- 15 Signal-Processing Means
- 16 Image Storage Means
- 17 Defective Pixel Detection Means
- 18 Defective Candidate Selection Means

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